

CLAIMS

1. A spool piece termination structure to be mounted to a spool piece so as to support a spool piece hub during the connection of the spool piece hub to a corresponding pipeline hub, **characterized** in that the termination structure (5) comprises
5 a clamping device (3) for clamping together said spool piece hub and pipeline hub, and that the termination structure (5) further comprises a base frame (7) openly shaped downwards so as to allow the termination structure (5) to receive a pipeline end section provided with said pipeline hub by lowering
10 the termination structure (5) downwards onto said pipeline end section.
2. A spool piece termination structure according to claim 1, **characterized** in that the termination structure (5) comprises
15 a guiding device (9, 51) for engaging the pipeline end section when received in the termination structure (5) so as to secure that the pipeline end section and the associated pipeline hub are properly received and positioned in the termination structure.
- 20 3. A spool piece termination structure according to claim 1 or 2, **characterized** in that the termination structure (5) is provided with landing means (8a, 8b) designed to allow the termination structure to rest on the seabed or on a fabricated subsea
25 foundation.
4. A spool piece termination structure according to any of the preceding claims, **characterized** in that the termination structure (5) comprises a lifting appliance (50) for lifting a pipeline
30 end section received in the termination structure (5) upwards in relation to the base frame (7).
5. A spool piece termination structure according to any of the preceding claims, **characterized** in that the clamping device

(3) is fixedly secured in relation to the base frame (7) so as to be displaceable together with the base frame (7).

- 5 6. A connection arrangement for subsea connection of a pipeline to a spool piece by clamping together a pipeline hub secured to an end section of the pipeline and a spool piece hub secured to an end section of the spool piece, **characterized** in:
- 10 - that the connection arrangement comprises a spool piece termination structure (5) according to any of claims 1-5,
- 15 - that the connection arrangement comprises an alignment structure (20) designed to be connectable to a pipeline end section received in the termination structure (5) by being lowered downwards onto said pipeline end section so as to come to bear against it, the alignment structure (20) being designed to receive, when it is lowered downwards onto said pipeline end section, at least a part of a flange of the pipeline end section, the alignment structure (20) comprising an alignment device (22) for properly aligning said flange and thereby the pipeline hub in relation to the alignment structure when received therein; and
- 20 - that the alignment structure (20) and clamping device (3) are designed to be displaceable in relation to each other when the alignment structure has come to bear against said pipeline end section and the pipeline end section flange has been received in the alignment structure so as to allow the pipeline hub and the spool piece hub to be mutually displaced into contact with each other.
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- 30 7. A connection arrangement according to claim 6, **characterized** in that the alignment structure (20) is designed to receive at least a part of a rotationally symmetric flange of a pipeline end section.
- 35 8. A connection arrangement according to claim 6 or 7, **characterized** in that the termination structure (5) and alignment structure (20) are provided with corresponding alignment members (15, 25) which are designed to allow contact with

each other when the alignment structure (20) and the clamping device (3) are displaced towards each other for the purpose of alignment of the alignment structure (20) in relation to the clamping device (3).

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9. A connection arrangement according to claim 8, **characterized** in that one of the alignment structure (20) and termination structure (5) is provided with at least one male-like alignment member (25), preferably in the form of a spear, which is designed to fit into a corresponding female-like alignment member (15), preferably in the form of a spear funnel, arranged on the other of said structures (20, 5).
10. A connection arrangement according to claim 9, **characterized** in that the respective male-like alignment member (25) is displaceably mounted in the associated structure (20) so as to allow the alignment member (25) to be retracted out of the corresponding female-like alignment member (15) without having to displace the entire alignment structure (20) in relation to the termination structure (5).
11. A connection arrangement according to claim 10, **characterized** in that the respective male-like alignment member (25) is displaceable by means of a hydraulic cylinder (28) arranged in the associated structure (20).
12. A connection arrangement according to any of claims 8-11, **characterized** in that the alignment structure (20) is provided with at least two alignment members (25), which are arranged in the alignment structure (20) so as to be located below and on either side of the centre line of a pipeline end section onto which the alignment structure (20) has been lowered.
13. A connection arrangement according to any of claims 8-12, **characterized** in that the respective alignment member (25) of the alignment structure (20) is designed to abut against the corresponding alignment member (15) of the termination

structure (5) for the purpose of aligning the hub mating faces at displacement prior to their mutual contact for final alignment.

5 14. A connection arrangement according to claim 12 or 13,
characterized in that the alignment structure (20) is provided
with at least two stop members (26), which are arranged in
the alignment structure (20) so as to be located above and on
10 either side of the centre line of a pipeline end section onto
which the alignment structure (20) has been lowered, the re-
spective stop member (26) being designed to abut against a
corresponding stop member (16) of the termination structure
(5) in the purpose of aligning the hub mating faces at dis-
placement prior to their mutual contact for final alignment.

15 15. A connection arrangement according to any of claims 6-14,
characterized in that the alignment device (22) of the align-
ment structure (20) comprises at least one force applying
member (22a) for forcing a received pipeline end section
20 flange against an abutment (23) of the alignment structure.

16. A connection arrangement according to claim 15, **charac-**
terized in that the alignment device (22) of the alignment
structure (20) comprises at least three force applying mem-
25 bers (22a) spaced apart in the circumferential direction of a
received pipeline end section flange for forcing said pipeline
end section flange against said abutment (23).

17. A connection arrangement according to any of claims 6-16,
30 **characterized** in that the termination structure (5) is designed
to receive a remotely operated connecting tool (30) provided
with force applying means (31a, 31b) for displacing the
clamping device (3) and the alignment structure (20) in rela-
tion to each other.

35 18. A connection arrangement according to claim 17, **charac-**
terized in that the termination structure (5) is provided with

5 guiding means (18) designed to co-operate with corresponding guiding means (33) on the connecting tool (30) so as to guide the connecting tool into a correct position in relation to the termination structure when the connecting tool is lowered downwards into contact with the termination structure.

10 19. A connection arrangement according any of claims 6-18, **characterized** in that the clamping device (3) is displaceable in relation to the alignment structure (20) by being displaceable together with the other parts of the termination structure (5) in relation to the alignment structure (20).

15 20. A method for subsea connection of a pipeline (1) to a spool piece (2) by clamping together a pipeline hub (1a) secured to an end section (1b) of the pipeline and a spool piece hub (2a) secured to an end section of the spool piece (2), wherein the following steps are performed:

- 20 - a spool piece termination structure (5), to which the spool piece hub (2a) is mounted and which comprises a clamping device (3), is made to receive the pipeline end section (1b) and the associated pipeline hub (1a) by lowering the termination structure (5) downwards onto said pipeline end section,
- 25 - the pipeline hub (1a) and the clamping device (3) are displaced towards each other so as to bring the pipeline hub (1a) and the spool piece hub (2a) with the clamping device (3) into contact with each other,
- whereupon the clamping device (3) is activated so as to clamp together the pipeline hub (1a) and the spool piece hub (2a).

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21. A method according to claim 20, **characterized** in:

- 35 - that an alignment structure (20) is connected to the pipeline end section (1b) received in the termination structure (5) by being lowered downwards onto said pipeline end section so as to come to bear against it, the alignment structure being made to receive, when it is lowered downwards onto the pipe-

line end section (1b), at least a part of a flange (1d) of the pipeline end section received in the termination structure,
- that an alignment device (22) arranged in the alignment structure (20) thereafter is activated so as to properly align
5 said flange (1d) and thereby the pipeline hub (1a) in relation to the alignment structure (20), and
- that the clamping device (3) and the alignment structure (20) thereafter are displaced towards each other so as to bring the pipeline hub (1a) and the spool piece hub (2a) with the clamp-
10 ing device (3) into contact with each other.

22. A method according to claim 21, **characterized** in that the alignment structure (20) is made to receive at least a part of a rotationally symmetric flange (1d) of the pipeline end section.

15 23. A method according to claim 21 or 22, **characterized** in that corresponding alignment members (15, 25) of the termination structure (5) and the alignment structure (20) are brought into contact with each other when the clamping device (3) and the
20 alignment structure (20) are displaced towards each other so as to properly align the pipeline hub (1a) in relation to the spool piece hub (2a).

24. A method according to any of claims 20-23, **characterized** in
25 that the alignment structure (20) and clamping device (3) are displaced in relation to each other by means of a remotely operated connecting tool (30) provided with force applying means (31a, 31b) for displacing the clamping device and the alignment structure (20) towards each other.

30 25. A method according to any of claims 20-24, **characterized** in that the pipeline hub (1a) and the clamping device (3) are brought into position to each other by displacing the clamping device (3) together with the other parts of the termination
35 structure (5) in relation to the pipeline hub (1a).

26. A pipeline termination to be applied to the end section of a pipeline so as to allow the pipeline to be connected sub-sea

- 5 to a spool piece, the pipeline termination (1e) comprising a pipeline hub (1a) designed for connection to a corresponding spool piece hub, **characterized** in that the pipeline termination (1e) further comprises a flange (1d) located behind the pipeline hub (1a) and designed to constitute a reaction shoulder for use in the alignment and displacement of the pipeline termination (1e) and the associated pipeline hub (1a) in relation to said spool piece hub.
- 10 27. A pipeline termination according to claim 26, **characterized** in that the flange (1d) is rotationally symmetric.